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Adjusting of Adult Voxel Phantom According to Anthropomorphic Measurements of Five years old Sudanese Pediatrics

A thesis submitted in partial fulfillment of the requirements for the
Master degree in medical physics

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2018

الاية

بسم الله الرحمن الرحيم

قال تعالى: ((وقل ربى زدنى علما))

الاية(114) من سورة طه

Dedication

To

Spirit of my father and my mother, my husband

My brothers and my sisters, my colleagues

And my teachers

*To all my love and all who have been appointed to
me in my way guide this humble effort*

Acknowledgements

At first thank for Allah Almighty! Before and after for this work.

Secondly I would like to Thanks Dr. ELHusseini, who offered to me this project and helped me along my way, then to Dr. Mustafa, head of the physics department, International University of Africa which I can't find the right words to appreciate them. Then thanks to the Radiation Center of Khartoum which is represented in all the staff of the department of medical physics.

Also I would like to thanks the special Branch Unis Co –IN statute the National Tutorial Net, excellence in engineer Mohammed Omar.

Lastly thanks to all the kindergarten Al Nabras, Future, Sanabel and Ahbab Allah where I got my data from.

المستخلص

لقد أسهم تصميم الموديلات الثلاثية الأبعاد بواسطة الحاسوب وعمل محاكاة لجسم الانسان باستخدام الأشعة المقطعية والرنين المغنطيسي في التشخيص ووضع خطة فاعلة للعلاج بالإشعاع. ويأتي هذا الأمر من الأهمية خاصة بالنسبة للأطفال نسبة لحساسيتهم العالية للإشعاع وبالتالي الهدف من هذه الدراسة هو المساهمة في وضع معايير بالنسبة للجرعة العلاجية للأطفال.

في هذه الدراسة تم تصميم موديل ثلاثي الأبعاد لطفل بعمر الخامسة، وذلك بتعديل موديل لشاب (ZOLNA) بعمر الثلاثين حيث ان طوله 183سم ووزنه 80 كجم ليصبح موديل الطفل (ZOLNA CHILD) بطول 110.40سم ووزن 17.81 كجم وقد أجريت التعديلات عن طريق اخذ قياسات لـ 84 طفل في عمر الخامسة من أربعة رياض أطفال سودانية وحسبت لها القيمة المتوسطة، وهذا التعديل تم للموديل الاصلي باستخدام برنامجي 3DMAX وAUTOCAD.

تم استخدام موديل الطفل (ZOLNA CHILD) في القياسات الإشعاعية وذلك باخذ مقطع من موديل الطفل وموديل الشاب من منطقة الصدر تظهر القلب والرئتين والنخاع الشوكي وعمل كنتور باتباع حواف الاعضاء الظاهرة وادخل هذا الكنتور في جهاز TPS وعرضت منطقة النخاع الشوكي لجرعة مقدارها 2 GY وفتحة حقل 6.1 X 6.4 بالنسبة للطفل و 7.8 X 7.1 بالنسبة للشباب وأجريت مقارنة بينهما. من النتائج المتحصل عليها وجد أن الجرعه توزعت على المنطقه المستهدفه (النخاع الشوكي) بنسبة 95% الى 100% وفي منطقة الرئتين بنسبة 80% الى 100% وفي المنطقه السلسلة الفقرية وتحديداً عند الفقرة الصدرية الخامسة T5 بنسبة 95% الى 80% بالنسبة للموديلين أما منطقة الأضلاع فكان هنالك إختلاف حيث كانت في النسبة للطفل 70% الى 20% وللشاب 40% فقط.

Abstract

The creation of 3D Models by computer and simulate the human body using CT and MRI have contributed to the use of radiation in diagnosis of disease and develop a treatment plan and treatment especially for pediatric because their sensitivity to radiation is very high.

This study created 3D voxel model for child in five years old by adjusting adult male model (ZOLNA) in 30 years old, his height is 183cm and weights 80 kg to become a model of child (ZOLNA CHILD) with height 110.40 cm and weight 17.81 kg. This adjusting was made by getting the dimensions from 84 child in five years old from four Sudanese kindergarten, and then calculate the average value for these dimensions. The adjusting phase for the reference model has been done by using 3DMAX and AUTOCAD programs.

The child (ZOLNA CHILD) model is used in the dosimetry by selecting a section for the child (ZOLNA CHILD) and adult (ZOLNA) models from the area of the chest which shows heart, lungs and spinal cord and then get contour by tracing the edges of the organs appears and finally entering this contour data in the TPS device. As input we gave the spinal cord dose about 2 Gy and open field size 6.1x6.4 for the child and 7.1x7.8 for the adult. Comparing the two models we found that the dose distribution in the target region got range from 100% to 95% and in the lung region from 80% to 10% and in vertebra region from 95% to 80% for both models but in ribs region for the child the range was 70% to 20% and for the adult was 40% .

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Abbreviation

Abbreviation	Meaning
CT	Computer Tomographic
Voxel	Volume Bixel
ORNL	Oak Ridge National Laboratory
MRI	Magnetic Resonance Imaging
CSG	Constructive Solid Geometry
ICRP	International Commotion Radiation Protection
NURBS	Non Uniform Rational B-Splint Surface
MCNP	Mont Carlo N-particle
LANL	Los Alamos National Laboratory
USA	United State of America
UF	University of Florida
Kerma	Kinetic energy released per unit mas
Gy	Gray
WR	Weighting factor
Sv	Sievert
WT	Respective Weighting factor
D_w	Dose of water
IAEA	International atomic Energy Agency
TRS	Technical report
PSDL	Primary Standard Laboratory
SSDL	Secondary Standard laboratory
PTB	Physikalisch Technische bundesanstalt in braunschweig
IBM	International Business Machines
FORTTRAN	Formula Translation
EGS	Electron Gamma Shower
GEANT	Geometry And Tracking
BREP	Boundary representation
3D	Three Dimension
TPS	Treatment Planning System
ETRAN	Electronic Transport
ITS	Intergratedtiger Series
GTV	Gross target volume
CTV	Clinical target volume
PTV	Planning target volume
RICK	Radiation isotop center of Khartoum